September 17, 1988

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

before the

ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE, et al.	)	Docket Nos. 50-443-OL 50-444-OL
(Seabrook Station, Units 1 and 2)	)	(On-Site Emergency Planning and Safety Issues)

AFFIDAVIT OF EDWARD B. LIEBERMAN

I, Edward B. Lieberman, being on oath, depose and say as follows:

1. I am the president of KLD Associates, Inc., and am responsible for the development of the Seabrook Station Evacuation Time Estimates and Traffic Management Plan Update. In addition, I have testified regarding such matters before the Licensing Board impaneled to hear offsite emergency planning issues in this docket. A statement of my professional qualifications is attached hereto and marked "A".

2. The purpose of this affidavit is to address allegations in Contention Basis A.5 regarding the effect of heavy traffic, nighttime conditions, and snow and ice associated with adverse winter conditions, on vehicle speed in general, and hence on the transit times of the VANS vehicles traveling pre-designated routes.

3. I have reviewed the empirical data of TRANSIT times which were tabulated on forms provided to the drivers performing a transit time study in April, 1988. The VANS vehicles were driven repeatedly from their respective staging areas to their acoustic locations; a total of 726 of such runs were performed to a total of 14 acoustic locations. The number of runs to each such location varied between 45 and 59. For three of these locations (Nos. 1, 9 and 12) one run exceeded a TRANSIT time of 10 minutes (10:05, 11:08, 14:18, respectively).

4. I have also reviewed the results of similar test runs which were performed during July and the first week in August, to quantify TRANSIT times during the summer (tourist) season. A total of 671 randomly distributed test runs to 14 acoustic locations were performed. A total of 48 runs to each such location was performed (except for 47 runs for No. 14). For one of these locations (No. 1), five runs, four of

which took place on weekends, exceed a TRANSIT time of 10 minutes.

5. It is my understanding that a new Satellite Staging Area located within 0.6 miles of Acoustic Location 1, will be manned on summer weekends. The route from that Satellite Staging Area to Acoustic Location 1 utilizes a road that is not a beach access road. It is my opinion that this route would not be congested by beach traffic and, in any event, the transit time of the VANS vehicle from this Satellite Staging Area to Acoustic Location 1 should be far less than 10 minutes.

6. It is my opinion that the study methodology of the test runs described in items 3 and 4 quantifies the average TRANSIT times of the VANS vehicles for both summer and non-summer seasons, and includes the effects of clear weather, inclement (rain) weather, and a range of traffic and nighttime conditions.

7. The transit studies do not provide direct empirical data detailing the VANS transit times during winter adverse road conditions. Winter adverse road conditions represent the situation where there is an accumulation of snow on the pavement which exceeds one-half inch in depth and the roads remain passable.

8. It is very unusual for roads to be impassable for a significant amount of time. During the preparation of the Seabrook Station Evacuation Time Study I interviewed the Police Chiefs of all Massachusetts towns in the 10-mile EPZ except Amesbury, and of all but two New Hampshire towns within the EPZ. These discussions indicated that snow plowing equipment is mobilized and deployed during the snowfall after an appropriate amount of snow has accumulated, in order to maintain passable roads. The general consensus was that snow plowing efforts are generally successful in maintaining roadway passage for all but the most extreme blizzards and icing conditions.

9. As detailed in George Harper's affidavit, a review of historical weather data shows that one half inch or more of snow falls on about 20 days or on about 5 percent of the days per year. While more than ½ inch of snow remains on the ground the speed reduction factor remains in effect.

10. It is estimated that snow reduces mean free-flow speed by 25 percent. (NHRERP Evacuation Time Study, p. 3-1) Traffic demand does not influence roadway capacity unless the demand rises to a level which exceeds capacity, i.e. when traffic flow operates at level of service F. Traffic volumes in the winter under normal (i.e., pre-evacuation) conditions

rarely reach the levels of roadway capacity (see discussion in item 4, pages E-2, E-3 of Vol. 6, NHRERP Evacuation Time Study). Since the VANS vehicles are mobilized prior to the order to evacuate, roadway capacity would not be affected by evacuating traffic volumes.

11. The 25 percent speed reduction to represent the affect of inclement winter conditions on speed, should be applied tc free-flow (unimpeded) speeds associated with clear weather and dry pavement conditions. The average speeds listed in Table 2-2 in Seabrook's FEMA-REP-10 report are based upon an April 1988 VANS Route Transit Time Study.

12. On this basis, the AVERAGE TRANSIT TIME, T_2, during adverse winter weather conditions (i.e., snow), is estimated from the empirically determined AVERAGE TRANSIT TIME, T_1, as follows:

$$T_2 = T_1/(1-0.25) = 1.33\ T_1$$

Applying this expression to the values of T_1 in Table 2-2, yields the following estimates of TRANSIT times during adverse winter weather conditions, T^2:

ACOUSTIC LOCATION	(T_1) AVERAGE TRANSIT TIME	(T_2) ADVERSE WINTER AVERAGE TRANSIT TIME
VL-01	8:34	11:24
VL-02	4:56	6:34
VL-03	6:21	8:27
VL-04	0:00	0:00
VL-05	0:00	0:00
VL-06	3:01	4:01
VL-07	5:07	6:48
VL-08	6:28	8:36
VL-09	7:43	10:16
VL-10	7:45	10:19
VL-11	8:05	10:45
VL-12	8:33	11:22
VL-13	7:59	10:37
VL-14	0:54	1:12
VL-15	3:01	4:01
VL-16	12:15	16:18

Edward B. Lieberman

September 20, 1988

The above-subscribed Edward B. Lieberman appeared before me and made oath that he had read the foregoing affidavit and that the statements set forth therein are true to the best of his knowledge.

Before me,

Notary Public
My Commission Expires: 3/30/89

ROCKSELLE LANDSMAN
Notary Public, State of New York
No. 52-4742819
Qualified in Suffolk County
Commission Expires March 30, 1989

PROFESSIONAL QUALIFICATIONS

EDWARD B. LIEBERMAN
Vice President

KLD ASSOCIATES, INC.

My name is Edward B. Lieberman and my business address is KLD Associates, Inc., 300 Broadway, Huntington Station, New York 11746. I am presently Vice President of KLD Associates, Inc.

I received the Bachelor of Science degree in Civil Engineering in 1951 from Polytechnic Institute of Brooklyn. I was awarded the Master of Science degree in Civil Engineering in 1954 from Columbia University and in Aeronautical Engineering in 1967 from Polytechnic Institute of Brooklyn. I am currently working on a Doctorate degree in Transportation Planning at the Polytechnic University. I am a member of the Chi Epsilon Honorary Fraternity.

With almost 30 years of professional experience, I have managed a number of major projects. I pioneered the development and application of traffic simulation models, making major state-of-the-art innovations in the traffic engineering profession. I have also been responsible for many engineering studies involving data collection and analysis and design of traffic control systems to expedite traffic flow and relieve congestion.

I have developed simulation models to study traffic performance on urban networks, freeways, freeway corridors

and two-lane, two-way rural roads. These programs include consideration of pedestrians, interaction with vehicular traffic, truck and bus operations, special turning lanes, and vehicle fuel consumption and emissions; both pretimed and actuated traffic signal controls are represented.

I was the Principal Investigator for the development of traffic signal control strategies for congested conditions in mid-Manhattan. These strategies were implemented and evaluated in the field. Field tests indicated substantial reductions in delay combined with increased vehicle throughput.

I was the Principal Investigator in the development of an interactive computer graphics (ICG) software system for displaying traffic simulation results generated by the NETSIM model. I designed the overall structure of the software for implementation on PC AT computers and, subsequently, on larger ICG work stations. This work was sponsored by FHWA.

I was responsible to a large extent for the theoretical development of DYNEV, a Dynamic Network Evacuation model. The DYNEV model consists of two major components: an equilibrium traffic assignment model and a macroscopic dynamic traffic simulation model designed for all types of roadway facilities (urban streets, freeways, rural roads).

DYNEV is designed to be used as a tool to develop and organized evacuation plans needed as part of general

disaster preparedness planning. DYNEV was used to analyze an existing evacuation scenario at the Con Edison Indian Point Nuclear Power Station and is currently being used to develop an extensive evacuation plan for the LILCO Shoreham Nuclear Power Station on Long Island, New York.

In developing this evacuation plan for the Seabrook Nuclear Power Station, my activities include definition of evacuation scenarios, definition of the evacuation network, development of traffic control treatments and of traffic routing patterns, analysis of trip tables, analysis of simulation results, optimization of evacuation strategies and the preparation of formal documentation.

I was responsible for the development of the I-DYNEV model, an interactive version and enhancement of the DYNEV model, under contract with the Federal Emergency Management AGency (FEMA). I-DYNEV, in turn, was integrated into the Integrated Emergency Management Information System (IEMIS), developed by FEMA. I-DYNEV was applied to estimate the evacuation times for the Emergency Planning Zones (EPZ) for eight nuclear power stations.

I developed course material and conducted training for emergency planning personnel at the National Emergency Training Center (NECTC) in Emmittsburgh, Maryland.

I was also responsible for the designs of the NESIM microscopic urban traffic simulation model (formerly UTCS-1) and of the SCOT freeway traffic simulation model. The

NETSIM microscopic traffic simulation model developed for the Federal Highway Administration, enables agencies to evaluate traffic operations in urban environments. The SCOT model was developed for the Transportation Systems Center of the Department of Transportation. This program includes a dynamic traffic assignment algorithm which routes traffic over a network in response to changing traffic flow characteristics to satisfy a specified origin-destination table. In addition, I have developed advanced traffic control policies for urban traffic for the FHWA-sponsored UTSC Project, as well as a bus preemption policy to enhance the performance of mass transit operations within urban environs.

I designed and programmed the advanced "Third generation" area-wide, cycle-free control policies for moderate and congested traffic flow for computer-monitored real-time systems. I also developed a cycle-based, off-line computational procedure named SIGOP-II, to optimize traffic signal timing patterns to minimize system "disutility."

I led a group of traffic engineers and systems analysts in developing a system of macroscopic traffic simulation models designed to evaluate Transportation Systems Management (TSM) strategies. This software system, named TRAFLO, also includes an equilibrium traffic assignment model. This model has been distributed to other agencies including FEMA.

I designed an "Integrated Traffic Simulation System," named TRAF, which will eventually incorporate all the best traffic simulation models available. Using structured programming techniques, TRAF integrates: NETSIM, TRAFLO, and ROADSIM, a microscopic rural-road simulation model.

I served as Principal Investigator on NCHRP Project 3-20 entitled, "Traffic Signal Warrants." This project involved both field data collection and the application of the NETSIM model to study intersection delay as a function of traffic volume, a type of control and geometrics. In turn, I developed and documented new signal warrants, some of which will be incorporated in the next version of the Manual on Uniform Traffic Control Devices (MUTCD).

Under NHTSA sponsorship, I directed a research study to evaluate a Driver Vehicle Evaluation Model named DTRVEM. This model simulates the response of motorists to hazardous events. This effort included analysis of the model formulation and software and sensitivity testing. A workship was designed, organized, scheduled and conducted by myself and other KLD professionals; experts from all over the U.S. were invited to recommend specific NHTSA research activities for the further development of the model. A recommended research program constituted the major output of the contract.

Over the years I have been involved in a number of other studies to evaluate traffic operations on large-scale road networks, using one or more of the models described above.

Prior to 1960 I applied my skills to the areas of stress analysis, vibrations, fluid dynamics and numerical analysis of differential equations. These analyses were programmed for the IBM 7090 and System 360, CDC 6600 and 7600, G.E. 625 and UNIVAC IIOB digital computers in assembly language, FORTRAN and PLI. I also designed the logic and real-time programming for a sonar simulator built for the Department of Navy and monitored by a PDP-8 progess-control digital computer.

I am a member of the American Society of Civil Engineers, the Institute of Transportation Engineers, the Association of Computing Machinery and the Transportation Research Board (TRB). I am also a member of the Traffic Flow Theory and Characteristics Committee of the TRB. I am a licensed Professional Engineer in New York, Maryland, and Florida.

The following list comprises selected publications of my studies and findings:

"DYNET - A Dynamic Network Simulation of Urban Traffic Flow," Proceedings, Third Annual Simulation Symposium, 1970.

"Simulation of Traffic Flow at Signalized Intersections: the SURF System," Proceedings, 1970 Summer Computer Simulation Conference, 1970.

"Dynamic Analysis of Freeway Corridor Traffic," SME paper, Trans. 70-42.

"Simulation of Corridor Traffic: The SCOT Model," "Highway Research Record No. 409, 1972.

"Logical Design and Demonstration of UTCS-1 Network Simulation Model," Highway Research Record No. 409 , 1972 (with R. D. Worrall and J. M. Bruggerman).

"Variable Cycle Signal Timing Program: Volumes 1-4," Final REport of Contract DOT-FH-11-7924, June, 1974.

"Traffic Signal Warrants," KLD TR-51, Final REport on NCHRP Project 3-20/1, December 1976 (with G. F. King and R. Goldblatt).

"Rapid Signal Transition Algorithm,"Transportation Research Record No. 509 , 1974 (with D. Wicks).

"Subnetwork Structuring and Interfacing for UTCS Project-Program of Simulation Studies," KLD TR-5, January, 1972.

"Development of a Bus Signal Preemption Policy and a System Analysis of Bus Operations," KLD TR-11, April, 1973.

"SIGOP-II - Program to Calculate Optimal, Cycle-Based Traffic Signal Timing Patters, Volumes 1 and 2," Final Report, Contract DOT-FH-11-7924, KLD TR-29 and TR-30, December, 1974. Summary report inTransportation Research Record 596, 1976 (with J. Woo).

"Developing a Predictor for Highly Responsive System-Based Contro," Transportation Research Record 596, 1976 (with W. McShane and R. Goldblatt).

"A New Approach for Specifying Delay-Based Traffic Signal Warrants," Transportation Research Special Report 153 - Better Use of Existing Transportation Facilities, 1976.

"Network Flow Simulation for Urban Traffic Control Systems," Vols. 1-5, PB230-760, PB230-761, PB230-762, PB230-763, PB230-764, 1974 (with R. Worrall), Vols. 2-4 updated 1977, KLD TR-60, TR-61, TR-62 (with D. Wicks and J. Woo).

"Extension of the UTCS-1 Traffic Simulation Program to Incorporate Computation of Vehicular Fuel Consumption and Emissions," KLD TR-63, 1976 (with D. Rosenfield).

"Analysis and Comparison of the UTCS Second- and Third-Generation Predictor Models," KLD TR-35, 1975.

"Urban Traffic Control System (UTCS) Third Generation Control (3-GC) Policy," Vol. 1, 1976 (with A. Liff).

"Design of TRAFIC Operating System (TOS), KLD TR-57, 1977.

"Revisions to the UTCS-1 Traffic Simulation Model to Enhance Operational Efficiency," KLD TR-59, 1977 (with A. Wu).

"The Role of Capacity in Computer Traffic Control," in Research Directions in Computer Control of Urban Traffic Systems, ASCE, 1979.

"Traffic Simulation: Past, Present and Potential," in Hamburger, W.S. and Steinman, L., eds., Proceedings of the International Symposium of Traffic Control Systems, University of California, Berkeley, 1979.

"TRAFLO: A New Tool to Evaluate Transportation System Management Strategies," presented at the 59th

Annual Meeting of the Transportation Research Board, 1980 (with B. Andrews).

"Determination of the Lateral Deployment of Traffic on an Approach to an Intersection," presented at the 59th Annual Meeting of the Transportation Research Board, 1980.

"Service Rates of Mixed Traffic on the Left-Most Lane of an Approach," presented at the 59th Annual Meeting of the Transportation Research Board, 1980 (with W. R. McShane).

"Development of a TRANSYT-Based Traffic Simulation Model," presented at the 59th Annual Meeting of the Transportation Research Board, 1980 (with M. Yedlin).

"Hybrid Macroscopic-Microscopic Traffic Simulation Model," presented at the 59th Annual Meeting of the Transportation Research Board, 1980 (with M. C. Davila).

"A Model for Calculating Safe Passing Distance on Two Lane Rural Road," presented at the 60th Annual Meeting of the Transportation Research Board, 1981.

"The TRAF System - Anayltic Formulation and Logical Design of the Roadsim Model," KLD TR-129, June, 1983.

"PREDYN User's Guide," KLD TR-131, June, 1983.

"The TRAF System - Technical Report," KLD TR-136, August, 1983 (with M. Yedlin, B. Andrew and K. Sheridan).

"Application of the I-DYNEV System to Compute Estimates of Evacuation Travel Time at Nuclear Power Stations -- Four Demonstration Case Studies," KLD TR-142, December, 1983.

"Users Manual for the Interactive Dynamic Network Evacuation Model: I-DYNEV,"KLD TR-144, February, 1984.

"Formulations of the DYNEV and I-DYNEV Traffic Simulation Models Used in EESF," KLD TR-154, March, 1984.

"PREDYN/IDYNEV Training Guide," KLD TR-155, April, 1984 (with R. Goldblatt).

"Specifications of Recommended Interactive Graphics Hardware Configuration and Graphics Support Software for the Netsim Graphics Display Package," KLD TM-93, July, 1985.

"Metering of High-Density Sectors Comparison of Traffic Operations Along Fifth Avenue in Mid-Manhattan: Metering Control vs. Existing Control," KLD TM-94, July, 1985.

"Description of an Integrated Traffic Assignment and Distribution Model (TRAD) for the IDYNEV System," KLD TR-187, April, 1986.

"Evacuation Plan Update (Robert G. Ginna [illegible]lear Power Station)," KLD TR-189, [illegible], 1986 (with R. Goldblatt).

"Evacuation Plan Update (Davis Besse)," KLD TR-190, July, 1986 (with R. Goldblatt).

"Seabrook Station Evacuation Time Estimates and Traffic Management Plan Update," KLD TR-174, August, 1986.

"Reducing Traffic Congestion at Herald Square," ITE Journal, September, 1986, pp. 27-31 (with A. K. Rathi).

"Congestion Based Traffic Control Scheme for High Traffic Density Sectors," Transportation Research Record No. 1057, TRB, National Research Council, Washington, D.C., 1986, pp. 49-57 (with A. K. Rathi and G. F. King).

"Overview of the Evacuation Plan and of the Evacuation Time Estimtaes for the Seabrook Nuclear Power Station," KLD TM-98, October, 1986.

"Overview of the Evacuation Plan and of the Evacuation Time Estimates of the Ginna Nuclear Power Station," KLD TM-99, November, 1986 (with R. Goldblatt).

"Overview of the Coastal Region within the Pilgrim Station Emergency Planning Zone," KLD TM-100, November, 1986.

"Enhanced Freflo Program: Simulation of Congested Environments," paper submitted for presentation at Transportation Research Board's 66th Annual Meeting, January, 1987 (with A. K. Rathi and M. Yedlin).

"The Netsim Graphics System," paper submitted for presentation at Transportation Research Board's 66th Annual Meeting, January, 1987 (with B. Andrews and A. Santiago).